of Pankov. Claims 1-4 and 15-22 are currently pending in the instant application.

The present invention is directed to a semiconductor material which is crystallized to have a peak of intensity of scattered light at a Raman shift of 512 cm^{-1} or more in Ramans spectroscopy thereof. Specifically, the semiconductor material is formed by melting a non-crystal semiconductor, which includes carbon, nitrogen and oxygen each at a concentration of $5x10^{19}$ atoms cm^{-3} or less and by irradiating the same with a laser beam or equivalent thereof to crystallize the non-crystal material. The semiconductor layer of the present invention may be used as an activation layer in a thin film transistor.

Claims 1-4 and 15-22 were rejected under 35 U.S.C. §103 over Pankove, in view of Wolf et al. Pankove discloses an insulating structure which includes electrically conductive portions. Specifically, a substantially insulating film of oxygenated silicon, which may be non-crystalline, is formed and then selectively irradiated with a YAG laser to form a conductive portion or portions. Pankove does not, however, disclose the use of carbon or nitrogen impurities, particularly such impurities maintained below a certain level. Further, as previously asserted, Pankove discloses an insulating starting material which is oxygenated.

Wolf et al. discloses a method for measuring the presence of oxygen and carbon in single crystal silicon and is relied upon by the Examiner to show that single crystal silicon may include oxygen and carbon as impurities. Specifically, the Examiner asserts that Wolf suggests the addition of impurities, such as carbon or nitrogen, to silicon.

Applicants respectfully traverse this assertion. There is absolutely no teaching or suggestion in Wolf to intentionally add these materials to a semiconductor without referring to the disclosure of the present invention.

Furthermore, as stated in the previous response, Wolf merely discloses a method for detecting the presence of certain materials contained in silicon. There is certainly no disclosure of maintaining the levels of carbon, nitrogen and oxygen at a concentration of 5×10^{19} atoms cm^{-3}.

Wolf is irrelevant to the non-single crystalline semiconductor of Pankov because Wolf is directed to a single crystal semiconductor. The tendency that C, N and O impurities are unintentionally introduced into a non-single crystalline semiconductor is much higher than the tendency that these impurities are naturally doped into a single crystalline semiconductor. Therefore, the disclosure of Wolf is not directly applicable to the teachings of Pankov, in that, the non-single crystalline semiconductor of Pankov would probably have a much higher impurity level that is recited in the claims of the present invention.

Moreover, even if these references are combinable, the patentability of the instant claims resides in the combination of providing a semiconductor with C, N and O at specific concentrations with a laser melt process. Applicants have discovered that electrical properties of the resulting semiconductor can be remarkably improved by this combination. Therefore, the combination of these reference is not sufficient to establish prima facie obviousness.

In view of paragraph 2 of page 3 of the Office Action, the Examiner assumes that the semiconductor layer of Pankov would inherently contain C and N at the claimed concentration absent any particular teachings to show how such impurities at the specified concentrations are achieved. Applicants have provided a particular teaching to show how such levels are achieved.

A silicon film formed by vapor deposition tends to naturally contain C, N and O at a concentration much higher than that of the claimed invention.

For this reason, care must be taken to reduce these impurities to the recited levels during the deposition. This is particularly discussed in the specification of the instant application on pages 10 and 11 which includes a method for accomplishing the presently claimed levels of impurities.

Applicants also respectfully traverse the Examiner's assertion that the recitation of the Raman shift should not be given patentable weight because it results from activities performed after the structure is formed. The recitation of Raman shift is a further means for defining the recited thin film over the prior art, in that the Raman shift of the film is a characteristic of the film.

Specifically, Raman shift directly relates to the electrical characteristics of the semiconductor, which, in the case of the present invention, represents an improved characteristic of the film of the present invention. The fact that the procedure for testing this shift occurs after the formation of the structure is irrelevant. If such a conclusion was correct, limitations such as melting point or boiling point would likewise be considered irrelevant in determining patentability, which is clearly not practiced or appropriate. Further, the process claimed in the invention facilitates the formation of the semiconductor of the present invention having the recited Raman shift. Therefore, applicants believe that both the process limitation and the Raman shift should be considered in determining patentability of the currently pending claims.

Also, as, previously noted, Pankove actually teaches away from the present invention by utilizing an oxygenated starting material. There is no suggestion in Pankove or Wolf to reduce the high level of oxygen. Nothing in either of these references teaches the use of a non-crystalline semiconducting starting material including the recited impurities, let alone at the recited impurity levels.

In view of the foregoing, it is respectfully requested that the rejections of record be reconsidered and withdrawn by the Examiner, that claims 1-4 and 15-22 be allowed and that the application be passed to issue. If the Examiner believes a conference would be of benefit in expediting the prosecution of the instant application, she is hereby invited to telephone counsel to arrange such a conference.

Respectfully submitted,

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